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# Chemical Process Fundamentals for Managers and Non-Specialist Engineers Training Course

12 – 16 April 2027  
Paris





## Chemical Process Fundamentals for Managers and Non-Specialist Engineers Training Course

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### Programme Summary

Chemical process fundamentals for managers and non-specialist engineers form the subject of this five-day training course at foundation level, ending in an annotated process walk-through of a unit from the participant's own plant. Many professionals in process plants decide on equipment, budgets and risk without a working grasp of how the process behaves. The approach moves from balances and fluid behaviour to separation, reaction, control, diagrams and process safety. Mars Training Centre UK delivers this programme in chemical process fundamentals.

### The Business Case

When managers and engineers from other disciplines cannot read a process flow diagram or follow a mass balance, decisions on shutdowns, capital requests and changes rely on others' interpretation. A shared process vocabulary shortens technical discussions and helps non-specialists recognise when a proposal affects safety or yield.

- Quality of Cross-Functional Decisions: Improves as non-specialists question process proposals with evidence rather than deferring.
- Management of Change Cycle Time: Shortens as reviewers grasp the process consequences of equipment and procedure changes.
- Process Safety Awareness: Rises as staff outside process engineering recognise hazards in diagrams and operating data.

### Principles and Evidence Base

- Conservation of Mass and Energy: Balances around units and whole plants underpin every calculation in Sessions 1 and 2.
- McCabe-Thiele Method: A graphical view of distillation stages explains separation performance in Session 3.
- ANSI/ISA-5.1 and ISO 10628: Symbols and diagram conventions guide the reading of flow diagrams and piping and instrumentation diagrams in Session 4.
- CCPS Risk Based Process Safety and IEC 61882: Process safety elements and the HAZOP method frame the safety review in Session 5.



## Intended Participants

- Engineers from other disciplines who work alongside process teams.
- Managers who approve budgets, shutdowns or changes on process plants.
- Commercial and finance staff who interpret yields, throughput and energy use.
- HSE professionals who review process hazards and incident reports.

The programme serves refineries, petrochemical and fertiliser plants, gas processing facilities and water treatment operations.

## Learning Outcomes

1. Participants will be able to construct simple mass and energy balances around a process unit.
2. Participants will be able to explain pressure drop, pump behaviour and heat exchanger duty using plant data.
3. Participants will be able to compare separation and reactor options and their effect on yield and energy use.
4. Participants will be able to interpret process flow diagrams, piping and instrumentation diagrams and basic control loops.
5. Participants will be able to identify major process hazards and the safeguards shown on plant documents.
6. Participants will be able to formulate informed questions for process engineers on proposed changes.

## Programme Structure

### Day 1: Chemical Process Fundamentals and Material Balances

What goes into and out of a process unit?

- Units, Flow Rates, Composition and Conversion Factors
- Mass Balance Around a Single Unit and a Recycle Loop
- Physical Properties: Density, Viscosity and Vapour Pressure
- Phase Behaviour and Simple Phase Diagrams
- Reading Yield, Throughput and Loss Figures

### Day 2: Fluid Flow and Heat Transfer

How do fluids move and how is heat added or removed?

- Pressure Drop in Pipes, Valves and Fittings
- Centrifugal Pumps, Compressors and Their Curves
- Energy Balance and Heat Duty Calculations
- Shell-and-Tube Exchangers, Fouling and Fired Heaters
- Utilities: Steam, Cooling Water and Compressed Air



## Day 3: Separation and Reaction

How are products separated and chemical change controlled?

- Distillation Columns and the McCabe-Thiele View of Stages
- Absorption, Stripping and Liquid Extraction
- Reaction Rate, Conversion and Selectivity
- Batch, Continuous Stirred Tank and Plug Flow Reactors
- Catalysts, Deactivation and Regeneration

## Day 4: Process Diagrams and Control

How is the process documented and kept on target?

- Block Flow and Process Flow Diagram Conventions Under ISO 10628
- P&ID Symbols and Tag Numbers Under ANSI/ISA-5.1
- Feedback Control Loops and PID Controller Behaviour
- Alarms, Trips and Safety Instrumented Functions
- Heat and Material Balance Tables on Design Documents

## Day 5: Applying Chemical Process Knowledge

How does process knowledge improve plant decisions?

- Process Safety Elements in the CCPS Risk Based Process Safety Framework
- HAZOP Guidewords and Nodes Under IEC 61882
- Tracing a Day 4 Diagram Using Day 1 to Day 3 Principles
- Reviewing a Management of Change Proposal as a Non-Specialist
- Annotated Process Walk-Through Completion

## Methodology

The programme relies on structured exercises built on a model gas processing train and a small refinery unit. Participants calculate balances, read data sheets and trace streams on real-format diagrams, linking each principle to a management decision. Cases come from refining, petrochemicals and water treatment.

- Suggested activity: Closing a mass balance on a distillation column from plant meter readings.
- Suggested activity: Tracing a control loop and its trip on a piping and instrumentation diagram.
- Suggested activity: Reviewing a proposed equipment change against its process consequences.



## Capstone Output

Each participant completes an annotated process walk-through of a unit from their own plant. It traces the main streams, marks key equipment and control loops, records hazards and safeguards and lists questions for process engineers. It serves as a briefing note for reviews and handovers.

## Frequently Asked Questions

### **Is chemical process fundamentals training suitable for managers with no engineering degree?**

Yes. It is set at foundation level, assumes only school mathematics and chemistry, and works every calculation step by step.

### **Which standards and models does the chemical process fundamentals programme rest on?**

It rests on the conservation of mass and energy, the McCabe-Thiele method, ANSI/ISA-5.1 and ISO 10628 for diagrams, the CCPS Risk Based Process Safety framework and IEC 61882 for HAZOP.

### **How is the annotated process walk-through from chemical process fundamentals training used at work?**

You can use it to brief colleagues, prepare for design or change reviews and ask process engineers sharper questions about proposals.

### **How does chemical process fundamentals training differ from a course on process plant troubleshooting?**

Troubleshooting courses train specialists to diagnose upsets. This programme helps non-specialists follow and question process decisions.